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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/846,536	05/02/2001	Wen-Ting Chu	TS1999-646B	4121

28112 7590 03/20/2003

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EXAMINER

NADAV, ORI

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 03/20/2003

13

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/846,536

Applicant(s)

CHU ET AL.

Examiner

ori nadav

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 January 2003.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 20-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 20-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☒ The proposed drawing correction filed on 14 January 2003 is: a) ☐ approved b) ☒ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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DETAILED ACTION

Drawings

1. The proposed drawing correction and/or the proposed substitute sheets of drawings, filed on 5/2/2001 have been disapproved because they introduce new matter into the drawings. 37 CFR 1.121(a)(6) states that no amendment may introduce new matter into the disclosure of an application. The original disclosure does not support the showing of a space between the metal spacers exposing a portion of a top surface of the recessed metal plug structure .

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 20-24 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Originally filed figure 7B clearly depicts that there is no space between the metal spacers such that a portion

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of a top surface of the recessed metal plug structure is exposed. The disclosure supports the illustration of figure 7B by not reciting that a space is formed between the metal spacers such that a portion of a top surface of the recessed metal plug structure is exposed. Therefore, there is no support in the disclosure for a space between the metal spacers exposing a portion of a top surface of the recessed metal plug structure, as recited in claim 20.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 20-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claimed limitation of a first portion located on a smooth top surface of the insulator layer situated only adjacent to one side of the via hole, as recited in claim 20, is unclear as to which element is situated only adjacent to one side of the via hole.

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Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 20, insofar as in compliance with 35 U.S.C. 112, is rejected under 35 U.S.C. 102(b) as being anticipated by Harada et al. (5,341,026).

Harada et al. teach in figure 1 and related text a metal structure 100 on a semiconductor substrate 1, a via hole in an insulator layer 5 exposing a portion of an underlying lower level metal interconnect structure, a recessed metal plug structure 206 located in a bottom portion of the via hole, with the recessed metal plug structure 206 overlying and contacting the portion of the lower level metal interconnect structure 4, exposed in the via hole; and the metal structure 100 comprised with a first portion 102, 103 located on a smooth top surface of the insulator layer situated only adjacent to one side of the via hole, and with the metal structure comprised with a second portion 101 attached to the first portion, wherein the second portion is a metal ring structure 101 comprised of metal spacers located on the sides of a top portion of the via hole and located overlying only first portions of a top surface of the recessed metal plug structure located at the bottom of the via hole, resulting in a space between the metal spacers exposing a second portion of the top surface of the recessed metal plug structure.

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Although Harada et al. do not explicitly state that layer 206 is a recessed plug, layer 206 can very well be characterized as a recessed plug, because layer 206 is formed in a bottom portion of the via hole, overlying, contacting and connecting the lower interconnect level 4 to the upper interconnect level. Therefore, Harada et al. teach a recessed plug, as claimed.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 21-24, insofar as in compliance with 35 U.S.C. 112, are rejected under 35 U.S.C. 103(a) as being unpatentable over Harada et al. (5,341,026).

Regarding claim 21, Harada et al. teach a lower level metal interconnect structure with an underlying and overlying titanium tungsten layer. Harada et al. do not teach a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness

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between about 100 to 1500 Angstroms. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a lower level metal interconnect structure with an underlying and overlying titanium nitride layer, wherein the lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, the underlying layer has a thickness between about 100 to 1500 Angstroms, and the overlying layer has a thickness between about 100 to 1500 Angstroms in Harada et al.'s device in order to protect the lower level metal interconnect structure with conventional barrier layer, of which official notice is taken, and because it is well within the skills of an artisan to use a lower level metal interconnect structure has a thickness between about 2000 to 20000 Angstroms, and underlying and overlying layers of a thickness between about 100 to 1500 Angstroms, respectively, in order to provide adequate conductivity to the device. Note that substitution of materials is not patentable even when the substitution is new and useful. *Safetran Systems Corp. v. Federal Sign & Signal Corp.* (DC NIII, 1981) 215 USPQ 979. Note further that the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the

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dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

Regarding claims 22-23, Harada et al. teach a recessed metal plug structure comprised of tungsten. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms in Harada et al.'s device, because it is well within the skills of an artisan to use a via hole having a diameter between about 0.10 to 1.0 microns, wherein the recessed metal plug structure has a height of between about 3000 to 20000 Angstroms, in order to reduce the size of the device and in order to provide adequate conductivity to the device, respectively. Note that the law is replete with cases in which when the mere difference between the claimed invention and the prior art is some dimensional limitation or other variable within the claims, patentability cannot be found. The instant disclosure does not set forth evidence ascribing unexpected results due to the claimed dimensions. See Gardner v. TEC Systems, Inc., 725 F.2d 1338 (Fed. Cir. 1984), which held that the dimensional limitations failed to point out a feature which performed and operated any differently from the prior art.

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Regarding claim 24, Harada et al. do not teach a metal ring structure comprising aluminum spacers. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a metal ring structure comprising aluminum spacers in Harada et al.'s device, in order to reduce the contact resistance between the upper level metal interconnect structure and the lower level metal interconnect structure. Note that substitution of materials is not patentable even when the substitution is new and useful. *Safetran Systems Corp. v. Federal Sign & Signal Corp.* (DC NIII, 1981) 215 USPQ 979.

Response to Arguments

10. Applicant argues that there is support in the disclosure for a space between the metal spacers exposing a portion of a top surface of the recessed metal plug structure, as recited in claim 20.

Originally filed figure 7B depicts that there is no space between the metal spacers such that a portion of a top surface of the recessed metal plug structure is exposed. The disclosure supports the illustration of figure 7B by not reciting that a space is formed between the metal spacers such that a portion of a top surface of the recessed metal plug structure is exposed. Therefore, there is no support in the

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disclosure for a space between the metal spacers exposing a portion of a top surface of the recessed metal plug structure, as recited in claim 20.

11. Applicant argues that Harada et al. do not teach a metal structure comprised with a first portion situated only adjacent to one side of the via hole..

It is unclear from claim 20 which element is situated only adjacent to one side of the via hole. Furthermore, if the first portion of the metal structure is the element situated only adjacent to one side of the via hole, Harada et al. teach that one side of the metal structure terminates at the edge of the via hole. Therefore, Harada et al. teach a metal structure comprised with a first portion situated only adjacent to one side of the via hole, as claimed.

12. Applicant argues that Harada et al. do not teach a discontinuity in the metal spacers as described by applicant, but rather a continuous metal structure 100..

Claim 20 recites a second portion being a metal ring structure comprised of metal spacers located on the sides of a top portion of the via hole and located overlying only first portions of a top surface of the recessed metal plug structure located at the bottom of the via hole, resulting in a space between the metal spacers exposing a second portion of the top surface of the recessed metal plug structure. Harada et al. teach a second portion being a metal ring structure 101 comprised of metal spacers located on the sides

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of a top portion of the via hole and located overlying only first portions of a top surface of the recessed metal plug structure located at the bottom of the via hole, resulting in a space between the metal spacers exposing a second portion of the top surface of the recessed metal plug structure, as claimed.

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Papers related to this application may be submitted to Technology center (TC) 2800 by facsimile transmission. Papers should be faxed to TC 2800 via the TC 2800 Fax center located in Crystal Plaza 4, room 4-C23. The faxing of such papers must conform with the notice published in the Official Gazette, 1096 OG 30 (November 15, 1989). The Group 2811 Fax Center number is (703) 308-7722 and 308-7724. The Group 2811 Fax Center is to be used only for papers related to Group 2811 applications.

Any inquiry concerning this communication or any earlier communication from the Examiner should be directed to *Examiner Nadav* whose telephone number is **(703) 308-8138**. The Examiner is in the Office generally between the hours of 7 AM to 4 PM (Eastern Standard Time) Monday through Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas, can be reached at **(703) 308-2772**.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Technology Center Receptionists** whose telephone number is **308-0956**



O.N.
March 18, 2003

ORI NADAV
PATENT EXAMINER
TECHNOLOGY CENTER 2800